

What is claimed is:

1. A semiconductor device, comprising:
 - a semiconductor substrate of a first conductivity;
 - and
 - a semiconductor layer provided on the semiconductor substrate and having a super junction structure including drift layers of the first conductivity and RESURF layers of a second conductivity different from the first conductivity, the drift layers and the RESURF layers being laterally arranged in alternate relation in a direction parallel to the semiconductor substrate, wherein
 - the RESURF layers are each provided alongside an interior side wall of a trench penetrating through the semiconductor layer, and
 - the drift layers each have an isolation region present between the RESURF layer and the semiconductor substrate to prevent the RESURF layer from contacting the semiconductor substrate.
2. A semiconductor device as set forth in claim 1, wherein
 - the RESURF layers are each provided alongside one of widthwise opposite interior side walls of the trench,
 - the drift layers are each provided alongside the other of the widthwise opposite interior side walls of the trench, and

a width of a portion of the drift layer between the trench and the RESURF layer as measured laterally is nearly equal to a width of the isolation region as measured vertically depthwise of the trench.

3. A semiconductor device as set forth in claim 1, wherein

the RESURF layers are provided alongside widthwise opposite interior side walls of the trenches, and

a width of a portion of the drift layer between two adjacent RESURF layers as measured laterally is generally double a width of the isolation region as measured vertically depthwise of the trench.

4. A semiconductor device as set forth in any of claims 1 to 3, further comprising:

base regions of the second conductivity each provided in contact with the drift layer and the RESURF layer;

source regions of the first conductivity each provided in contact with the base region and isolated from the drift layer and the RESURF layer by the base region; and

gate electrodes each provided in opposed relation to a portion of the base region between the source region and the drift layer with the intervention of a gate insulation film.

5. A production method for a semiconductor device which includes a semiconductor layer provided on a semiconductor substrate of a first conductivity and having a super junction structure including drift layers of the first conductivity and RESURF layers of a second conductivity different from the first conductivity, the drift layers and the RESURF layers being laterally arranged in alternate relation in a direction parallel to the semiconductor substrate, the production method comprising the steps of:

forming a semiconductor layer of the first conductivity on a semiconductor substrate of the first conductivity;

performing a first trench formation process to form a trench in the semiconductor layer, the trench having a depth such as to reach a middle of the semiconductor layer;

after the first trench formation step, performing an in-trench impurity introduction process to introduce an impurity of the second conductivity into a portion of the semiconductor layer exposed to an interior side wall of the trench for forming a RESURF layer of the second conductivity alongside the interior side wall of the trench; and

after the in-trench impurity introduction step, performing a second trench formation process to deepen

the trench to a depth such as to penetrate through the semiconductor layer to reach the semiconductor substrate.

6. A production method for a semiconductor device which includes a semiconductor layer provided on a semiconductor substrate of a first conductivity and having a super junction structure including drift layers of the first conductivity and RESURF layers of a second conductivity different from the first conductivity, the drift layers and the RESURF layers being laterally arranged in alternate relation in a direction parallel to the semiconductor substrate, the production method comprising the steps of:

forming a semiconductor layer of the first conductivity on a semiconductor substrate of the first conductivity;

forming a trench in the semiconductor layer, the trench penetrating through the semiconductor layer to reach the semiconductor substrate; and

performing an in-trench impurity introduction process to implant an impurity of the second conductivity at an inclination angle into a portion of the semiconductor layer exposed to an interior side wall of the trench for forming a RESURF layer of the second conductivity in the portion of the semiconductor layer alongside the interior side wall of the trench, the inclination angle being such that the impurity reaches a limited depthwise range of

the interior side wall of the trench shallower than the semiconductor substrate.

7. A semiconductor device production method as set forth in claim 5 or 6, wherein

the in-trench impurity introduction step includes the step of performing an implantation process to implant the impurity of the second conductivity into a surface portion of the semiconductor layer exposed to the interior side wall of the trench,

the production method further comprising the step of performing a thermal diffusion process to heat the resulting semiconductor substrate after the implantation step for diffusing the implanted impurity into the semiconductor layer for the formation of the RESURF layer.

8. A semiconductor device production method as set forth in any of claims 5 to 7, further comprising the steps of:

introducing an impurity of the second conductivity into a surface portion of the semiconductor layer to form a base region of the second conductivity in contact with the RESURF layer;

introducing an impurity of the first conductivity into a portion of the base region to form a source region of the first conductivity which is isolated from the drift layer and the RESURF layer by a remaining portion of the

base region;

forming a gate insulation film opposed to the portion of the base region between the source region and the drift layer; and

forming a gate electrode opposed to the portion of the base region between the source region and the drift layer with the intervention of the gate insulation film.